810 to 1,500 years, the yew from 1,214 to 2,820, and the Baobab (*Adansonia digitata*) to 5,000 years, the author points out that these figures have been based upon the general assumption of each concentric ring of wood being the growth of one year. Speaking of his own experience, he says:—"I have carefully examined and counted the annual layers of a great many specimens—taking generally the average of the trees—with the view to show the common and comparative rates of growth, and have tabulated them to afford an opportunity of noticing any variations there may have been in the time required to form the wood in each of the several given diameters of 6, 12, 18 inches," &c. In these tables it is shown that in fifteen specimens of oak, the diameter of whose stems were in all cases 6 inches, the number of rings ranged from 12 to 49; in the same number of sections measuring 12 inches diameter they ranged from 19 to 105, and in those of 18 inches diameter from 24 to 160. In sections of Greenheart (*Nectandra Rodiœi*) of 6, 12, and 18 inches diameter, the concentric rings were respectively 37, 60, and 83, while in Mexican mahogany of the same dimensions the result showed the number of rings at 17, 30, and 44. In most cases from six to ten sections were examined, and the average so obtained.

In the matter of ordinary timber the information given is varied and tolerably complete, and the opinions of the author as regards strength, durability, and value for practical purposes may, of course, be taken as the opinion of one having experience and authority to speak on such matters. Moreover, the tables showing the breaking weights of the different woods and their specific gravities are the results of actual experiments. It is much to be regretted that in a work of this kind, which has not been produced without some care, more attention has not been given to scientific accuracy, not only in tracing out the sources of the woods mentioned, but also in bringing what botanical nomenclature has been attempted down to modern times. Thus, for instance, the "Maçaran duba" of Brazil (p. 182) might have been accredited as being a species of *Mimusops*, the "Cedro," on the following page, not as a species of "Cedar" but of *Cedrela* (*Cedrela odorata* probably), and the "Vinhatico," (p. 186) probably *Persea indica*. Again, with regard to African oak or teak, it is stated to be "probably the *Swietenia senegalensis* or *S. Khaya*," but it is well known that the durable timber commonly known under the above names is produced by *Oldfieldia africana*, a Euphorbiaceous tree. The Cuban Sabicu wood, likewise, of which the stairs of the great Exhibition building in Hyde Park in 1851 were constructed, and which, we believe, are still in use at Sydenham—such is the durability of the wood—is described as being produced by *Acacia formosa*, but it is under *Lysiloma sabicu* that any description of this wood is to be found in works of a botanical character.

It is not with the view of depreciating the value of the book that we point out these errors. In a new edition, with the aid of a botanist and a determination to extend the scope of the work so as to include all woods known in commerce, the value of the book might be considerably enhanced. As it is, however, besides the technical details there are numerous interesting facts distributed through its pages, many of which are new to us.

JOHN R. JACKSON

*RECENT FRENCH EXPERIMENTAL PHYSIOLOGY**

Physiologie Expérimentale. Travaux du Laboratoire de M. Marey. (Paris: G. Masson, 1876.)

THE second of the memoirs in the work before us, by M. Marey, contains the description of a new *schema*, or dynamical model of the circulatory system, which from the ingenuity of its construction calls for special notice.

M. Marey, not satisfied with the original attempt of Weber to reproduce the phenomena of the circulation in a system of elastic tubes, nor with his own earlier efforts in the same direction, was led to the construction of the one to be noticed immediately. He tells us that all previous models were correct enough in imitating certain special points in the vascular circulation, but these were at the expense of, and to the total neglect of, others. The perfect reproduction of each phase is the end he has had in view in the construction of the new apparatus.

It can be proved without doubt that the heart takes a longer time to relax than to contract; the systolic curve, when represented graphically, is therefore more abrupt than the diastolic. To represent this on paper mechanically, the easiest method is by the employment of a cam or eccentric, which, as it turns, lifts a lever resting upon it and following the variation in its eccentricity.

In Fig. 1 the winch handle turns an axle on which two cams are fixed, the whole being connected with the two steady-arms and the immovable upright board on the left-hand side. A flywheel tends to render the rotation of the axle uniform. The irregularly-shaped eccentrics (C.V. and C.O.), the form of which will be explained further on, each move one of the smaller boards to the right of the figure, because these are pressed towards the left by the elastic spring F, and the dilatation of the cavities of the artificial heart (V and O), whilst they are being refilled. They transmit their movements through the intervention of the fixed pulleys attached to the boards, which latter again act on the artificial heart by the strain they exercise upon the cords S.O. and S.V. The action of the auricle being intermittent, the machine is so arranged that the cord S.O. is lax (as in the figure) during the time that it is at perfect rest. The ventricle never being in a state of true repose, but always in a state of contraction or expansion, it does not require the extra apparatus.

The artificial heart is constructed with caoutchouc cavities, supplied with valves to represent those in the human circulation. The *auricle* is covered with netting, to which four parallel cords, running through holes in the big board, are attached. The cords are fixed on a square piece of wood, which is kept in position by a spiral spring, and in connection with the moving board by the thread S.O. The *ventricle* has over it a case (white in the figure) to the edges of which cords are fixed, which are attached at their other ends to a board, which is put into communication with the moving board by means of the hooks and elastic rings (F), and the cord S.V. It is evident that any strain on the cords S.V. or S.O. will compress the auricle (O) and the ventricle (V) against the main board to which they are attached, and so produce a systole of these viscera. A magnified view of this artificial heart, into the cavities of which recording "ampoules" have been introduced, is given in Fig. 2.

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* Continued from p. 146.

As to the construction of the cams, M. Marey draws a curve to represent the systole and diastole of the ventricle of the actual heart, figuring it as a simple rise followed by a less abrupt fall. He divides the linear horizontal projection of this by twenty equidistant points, from which he projects the same number of parallel vertical lines, or ordinates. Taking a small board he draws on it a circle, from the centre of which radiate twenty equidistant lines, of which, when one has been measured off so as to equal in length the first ordinate of the cardiac horizontal curve, the others are made to correspond with the second, third, &c. On uniting by a line the extremities of these rays, a closed curve is the result, which must form the edge of the cam C.V. The cam C.O. is constructed in a similar manner from the auricular trace.

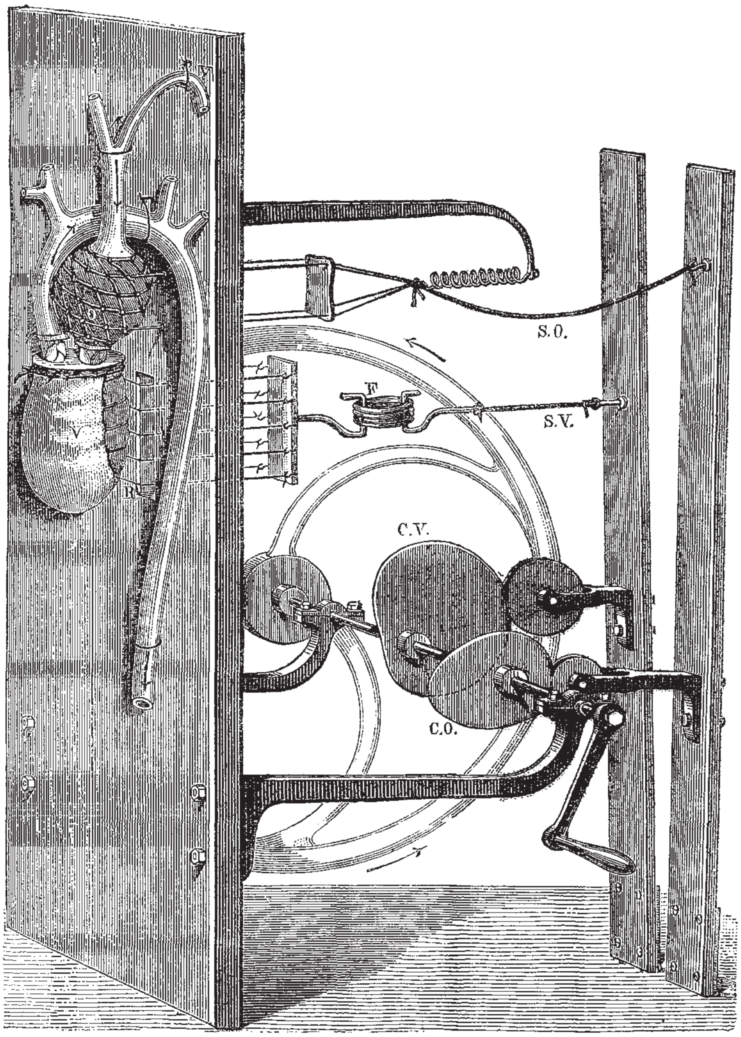

FIG. 1.

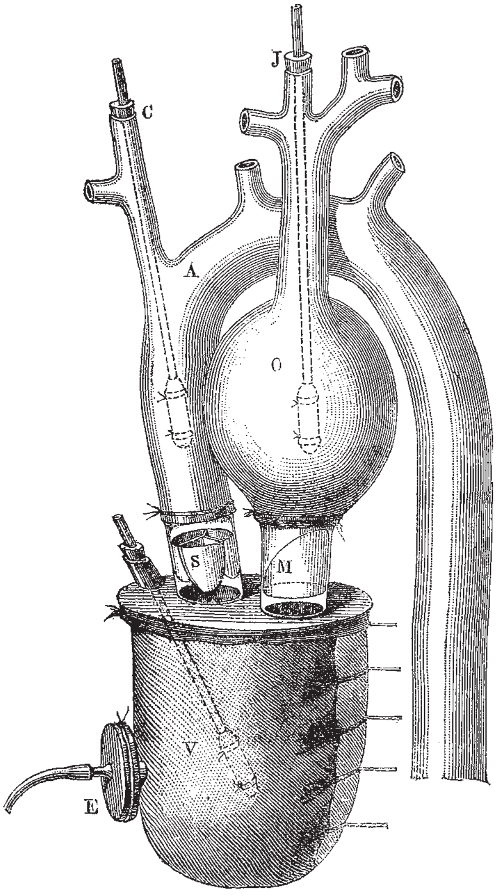

FIG. 2.

When the cams are placed on the axle of the machine in such a position that its rotation in one direction at a certain speed produces a compression (or systolic movement) by the auricular one at the interval of time before that of the ventricular which elapses between the systoles of the living auricles and ventricles, then the actual cardiac revolution is correctly imitated both in this particular and in the relative duration of the systoles themselves.

To verify the accuracy of the arrangements in the above-described *schema*, traces have been taken from it similar to those from the auricles, ventricles, and arteries of the horse. Fig. 2 illustrates the actual position, in the artificial heart, in which the elastic ampoules (sacs filled with air) which transmit its movements to recording levers (Fig. 3) were placed; and Fig. 4 is a simultaneous tracing from the four, the fourth being that of the motion of the heart-wall at E. The top curve is that from the auricle; the next is from the ventricle; and the third from the aorta.

In Figs. 1 and 2 the proximal vessels alone are represented to save confusion.

M. Marey claims for this his new *schema* that with it he can reproduce all the phenomena of the cardiac circulation; at the same time that with it he can master all the theories with reference to the significance of the most important elements of the pulsation of the heart. In this we think he is too sanguine ; for there are fundamental elements of the cardiac circulation which it is quite unable to indicate even the existence of by means of it. One of the most important of these is the fact that the relative length of the systole and diastole varies with the rapidity of the pulse, a most important point not at present sufficiently laid stress on. Another is the active diastole of the ventricle, which immediately follows the closure of the aortic valve. These and other minor considerations all go to prove that, though the new *schema* of the circulation is a great improvement upon all others yet introduced, nevertheless the exact representation of acts so complicated as the systole of muscular cavities cannot yet be imitated by the employment of the unaided mechanical powers.

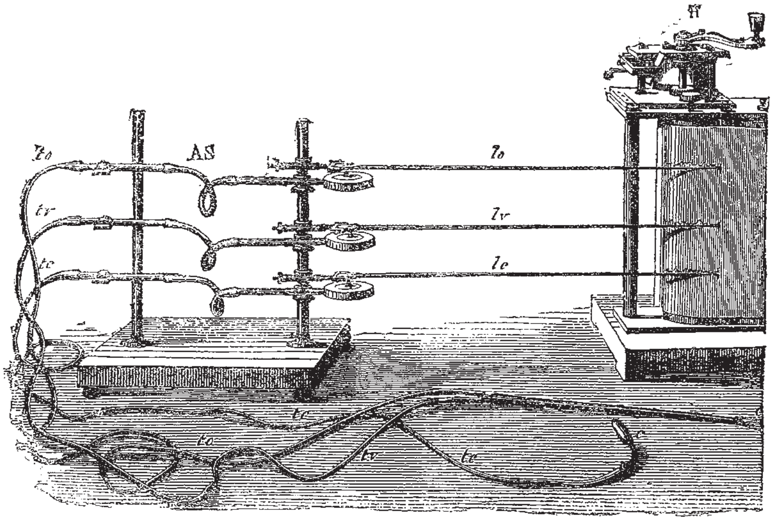

Fig. 3.

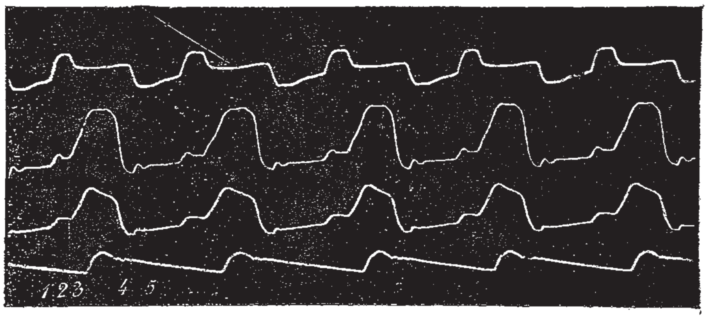

Fig. 4.

DAMMANN'S RACE-PHOTOGRAPHS

Ethnological Photographic Gallery of the Various Races of Man. By C. and F. W. Dammann. (London: Trübner and Co.)

THE science of anthropology owes not a little to the art of photography. It is true that in previous times some few artists took the trouble to draw careful race-portraits. Catlin's American Indians (particularly the large copies) and Burchell's Hottentots and Bushmen, were among those of real value. But most engravings of race-types to be found in books were worthless, either wanting the special characters of the race, or absurdly caricaturing them. Now-a-days, little ethnological value is attached to any but photographic portraits, and the skill of the collector lies in choosing the right individuals as representatives of their nations. Thus the great *Anthropologisch-Ethnologisches Album* of Carl Dammann of Hamburg, completed some months go, is one of the most important contributions ever made to the science of man. Consisting of fifty plates, portfolio size, with ten to twenty photographs on each plate, it goes far toward an adequate representation of man in all his varieties. A copy may be seen at the Anthropological Institute, but its cumbrousness and cost (18*l.*) are beyond the limits of most private libraries. It is therefore satisfactory that the publishers have now brought out a smaller educational atlas, price 3*l.* 3*s.*, containing from 150 to 200 portraits, in a binding suitable for a drawing-room book. We wish it all success, for it will make new anthropologists wherever it goes.

The plan on which the portraits are arranged is mainly geographical, exact race-division being from the nature of the case impracticable. Indeed one of the effects of both the large and small albums will be in a negative direction. They will do more than any quantity of written criticism to check the rash generalisation as to race so common in ethnological systems, and they will do this by impressing on the minds of students the real intricate blending of mankind from variety to variety. It is not impossible that some day the time may come for scientifically calculating the constitution of a race, on Quetelet's principle of a central type with gradually decreasing variants. But that time has not come yet, and the most